

FISHES OF THE GENUS *NANSENIA* (MICROSTOMATIDAE) WITH DESCRIPTIONS OF SEVEN NEW SPECIES

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ABSTRACT. The microstomatid fishes of the genus *Nansenia* are reviewed on a worldwide basis and 13 valid species are recognized. Of the 10 nominal taxa six species are recognized: *N. candida* (with *N. sanrikuensis* as a possible synonym), *N. groenlandica*, *N. atlantica*, *N. oblita*, *N. crassa*, and *N. ardesiaca* (with *N. tanakai*, *N. schmitti*, *N. macrolepis*, and *N. robusta* as synonyms). Seven new species are described based on specimens collected from the Atlantic, Pacific, and Antarctic oceans. Original descriptions are presented for *N. ahlstromi*, *N. antarctica*, *N. pelagica*, *N. megalopa*, *N. longicauda*, *N. tenera*, and *N. tenuicauda*. The species of *Nansenia* are separated into two groups based on the number of branchiostegal rays, either three or four; species of each group are distinguished on the basis of the differences in vertebral and gill raker counts, predorsal length in percent of standard length, and proportional size of the caudal peduncle. A key is presented.

Five species, *N. atlantica*, *N. oblita*, *N. megalopa*, *N. tenera*, and *N. tenuicauda* occur only in the Atlantic; three, *N. ahlstromi*, *N. candida*, and *N. crassa*, are limited to the Pacific. *Nansenia ardesiaca* is widespread in the slope waters of southeast Asian seas, extending northward to off southern Japan and westward to off South Africa. *Nansenia groenlandica* occurs in the subarctic Atlantic and subantarctic eastern Pacific. Antarctic waters are inhabited by a circumpolar species, *N. antarctica*. *Nansenia pelagica* and *N. longicauda* are found in both the Atlantic and Pacific oceans; the latter species restricted to the Northern Hemisphere. Distributional patterns of *Nansenia* are discussed in relation to those of other midwater fishes.

Six species exhibit allometric growth of head length, predorsal length, and eye diameter. Allometry may be an adaptation to mesopelagic and benthopelagic habitats.

INTRODUCTION

Fishes of the microstomatid genus *Nansenia* are distributed widely in the world ocean. They are found in oceanic and coastal waters from the subarctic to the subantarctic. Collections from both midwater and bottom trawls suggest that these fishes inhabit the epi- and mesopelagic zones and also the benthopelagic zone of continental or insular slopes. In areas of high productivity examples of *Nansenia* often exceed

200–300 mm in standard length and are sometimes captured in large numbers.

Notwithstanding the considerable numbers of adults and juveniles taken with trawls and larvae collected in plankton nets, the species are poorly known. Cohen (1958) examined specimens of six of seven nominal species that had been referred to *Nansenia* and concluded that the paucity of material precluded a critical revision. Since 1958 no comprehensive taxonomic work has been done on the genus, although four additional species have been described (Blache and Rossignol, 1962; Lavenberg, 1965; Abe, 1976; Kanayama and Amaoka, 1983). In general, specimens of *Nansenia* are soft-bodied, poorly ossified and hence often collected in poor condition. As a result the nominal species are inadequately known and a considerable number of species remain undescribed. Some species are distributed worldwide, but in previous works geographical variation and clines were not considered, and specimens from new localities were named as new species. The degree of ossification is different, both among species and growth stages, which, combined with the lack of a complete size series for all species, makes comparative osteology difficult. For all these reasons it is not possible at this time to present a comprehensive definition of the genus.

The present study is a preliminary one that aims to diagnose each species, both previously described and ones described in this paper with the objective of contributing information that will lead to a clearer definition of *Nansenia* and to the osteology, phylogeny, zoogeography, early life history, and ecology of each species.

METHODS AND MATERIALS

Measurements were taken with dividers and recorded to the nearest 0.1 mm. Unless otherwise indicated, definitions follow Hubbs and Lagler (1964) and include the following: standard length (SL); length of head (HL); depth of body (BD)—vertical through origin of base of dorsal fin; least depth of caudal peduncle (CPD); caudal peduncle length (CPL); diameter of eye (ED)—horizontal distance between opposite

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margins of socket; snout length (Sn); interorbital length (In-
tor); width of body (BW)—width just behind the head; pre-
dorsal length (Pre D); preanal length (Pre A); preventral length
(PreV)—distance from tip of snout to structural base of out-
ermost ventral fin ray. Size of specimen is recorded in stan-
dard length, with standard deviation and range in parenthe-
ses. Center of body is the midpoint of standard length. If
allometric growth is indicated for a species, data are pre-
sented for different size groups.

Numbers of vertebrae and median fin rays were counted
from radiographs. The ultimate double rays of the anal and
dorsal fins were counted as one. The short spine sometimes
found at the base of the outermost pelvic fin ray was not
counted. In other counts, all elements were included. The
upturned ural centra were counted as one. Teeth were count-
ed on both sides of the upper and lower jaws. Frequency
distributions of gill raker and vertebrae counts are shown
with the number of specimens in parentheses following each
count.

In the materials section of each species, catalogue numbers
are followed by the number of specimens and their size range
in parentheses. The station number is preceded by the cruise
number unless other wise indicated. The sampling depth is
indicated by m and the length of wire out by mwo. The
following institutional abbreviations are used.

UBC	Institute of Fisheries, University of British Colom- bia, Vancouver, Canada.
CAS	California Academy of Sciences, San Francisco, USA.
FMNH	Field Museum of Natural History, Chicago, USA.
ISH	Institute für Seefischerei, Hamburg, West Germany.
KU	Kochi University, Japan.
KYO	Department of Fisheries, Kyoto University, Japan.
LACM	Natural History Museum of Los Angeles County, USA.
OSU	School of Oceanography, Oregon State University, Corvallis, USA.
SIO	Scripps Institution of Oceanography, University of California, La Jolla, USA.
SWFC	Southwest Fisheries Center, National Marine Fish- eries Service, La Jolla, USA.

UF	Florida State Museum, University of Florida, Gainesville, USA.
USNM	National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA.
ZMUC	Zoologiske Museum, University of Copenhagen, Denmark.

Genus *Nansenia* Jordan and Evermann, 1896

Nansenia Jordan and Evermann, 1896:528 (type species by
monotypy, *Microstomus grønlandicus* Reinhardt, 1839; cf.
Follet and Cohen, 1958).

Bathymacrops Gilchrist, 1922:531 (type species by mono-
typy, *Bathymacrops macrolepis* Gilchrist, 1922).

Euproserpa (subgenus) Fowler, 1934:256 (type species by
original designation, *Microstoma schmitti* Fowler, 1934).

The definition of the genus *Nansenia* adopted here basically
follows Chapman (1942, 1943, 1948) and Cohen (1964). The
placement of the genus *Nansenia* in the family Microstom-
idae follows Ahlstrom et al., 1984. Body slender, subcylin-
drical or slightly compressed. Dorsal adipose fin present on
the last quarter of body. Predorsal length less than 61 percent
of SL. Snout shorter than half of eye, which is directed lat-
erally and is not tubular. Branchiostegals three or four. Anal
fin rays 8–10 (rarely 11). Pectoral fins inserted on sides of
the body. Parietals large and meeting on the midline. No
teeth on premaxillary or maxillary. Teeth present on pala-
tines, head of vomer and dentaries.

REMARKS. The difference between *Nansenia* and *Bathy-
lagus* (presently placed in a separate family, Bathylagidae) is
not clear, despite efforts to discover adequate diagnostic char-
acters. Characters concerned with the swimbladder, the oto-
liths, and morphology of the larvae, which may be diagnostic,
are not always known for all members of both genera at
different growth stages. Their value for distinguishing the two
genera remains to be confirmed.

The arrangement of the parietals, which have been re-
ported to meet broadly on the midline in *Nansenia*, but not
meeting in *Bathylagus* (Chapman, 1942, 1943, 1948; Cohen,
1964), is probably diagnostic if it is partly modified to pa-

Table 1. Counts and measurements used in the key to the species with three branchiostegal rays and distributional information.

Species	Vertebrae	Gill rakers	Predorsal distance (% SL)	Ratio CPL/CPD ¹	Distribution
<i>N. ahlstromi</i>	35–36	40	50.5–55.8	1.0–1.3	Subtropical Eastern Pacific, 20°N–35°N
<i>N. candida</i>	44–47	26–31	49.4–57.6	1.8–2.2	Subarctic Pacific, 30°N–55°N
<i>N. grønlandica</i>	42–45	37–45	43.7–45.6	2.8–4.0	Subarctic Atlantic, 40°N–70°N; Eastern South Atlantic
<i>N. antarctica</i>	49–50	35–41	45.9–47.7	2.0–2.5* 2.5–3.0**	Southern oceans, 40°S–60°S

¹ Caudal peduncle length to caudal peduncle depth.

* <110 mm SL.

** >110 mm SL.

Table 2. Counts and measurements used in the key to the species with four branchiostegal rays and distributional information.

Species	Vertebrae	Gill rakers	Predorsal length (% SL)	Caudal peduncle length (% SL)	Caudal peduncle length (% SL)	Ratio CPL/CPD ¹	Distribution
<i>N. pelagica</i>	38–39	36–41	50.4–57.8	11.5–13.3	8.1–11.3	1.1–1.5	Tropical and Subtropical Atlantic and Pacific
<i>N. atlantica</i>	41–42	30–36	51.9–56.9	11.3–12.2	8.2–8.6	1.4–1.5	Tropical Atlantic
<i>N. oblita</i>	42–45	30–36	55.0–56.1	9.3–12.2	8.2–9.6	1.1–1.2	Mediterranean and Eastern North Atlantic
<i>N. crassa</i>	43–46	35–37	49.0–60.2	13.0–15.2	6.3–7.7	1.7–2.2	Eastern Tropical and Subtropical Pacific
<i>N. megalopa</i>	44–45	21–23	42.1–44.2	15.6–17.6	5.2–5.7	2.8–3.2	Tropical Atlantic
<i>N. longicauda</i>	47–50	23–27	41.8–46.0	15.4–18.6	4.3–5.6	3.0–4.1	North Atlantic and North Pacific, 20°N–40°N
<i>N. tenera</i>	42–43	43–46	43.4–45.8	12.6–15.0	6.2–6.5	1.9–2.4	Subpolar and Temperate Atlantic
<i>N. ardesiaca</i>	46–48	27–35	45.7–48.5	13.0–15.0	6.1–7.5	1.7–2.3	Off Japan, Southeast Asia and East Africa
<i>N. tenuicauda</i>	46	38–42	44.0–45.8	13.5–13.9	4.4–5.0	2.7–3.1	South Atlantic

¹ Caudal peduncle length to caudal peduncle depth.

rials of *Bathylagus* not meeting or meeting at a point in the anteriormost part on midline. Branchiostegal counts are three or four in *Nansenia*, but mostly two in *Bathylagus*. However at least one undescribed bathylagid examined during the present study had exceptionally three branchiostegals. Anal fin ray counts are also useful in separating the two genera: 8–10 (rarely 11) in *Nansenia* and 12–28 (rarely 11) in *Bathylagus*. Better diagnostic characters for the genus *Nansenia* must await a revision of the family Bathylagidae.

KEY TO SPECIES

The species of *Nansenia* are separated into two groups based on branchiostegal counts of three or four. Four species have three branchiostegals and nine have four.

Counts and measurements used in the keys and distributional data are presented for all species in Tables 1 and 2 and Figures 21 and 22. After identification is made with the key, specimens should be checked against the information in the tables and also against the detailed descriptions of each species. The number of branchiostegal rays of *Nansenia* is stable within species, but careful examination under a dissecting microscope is necessary to recognize the innermost small ray (Fig. 1).

KEY TO SPECIES OF *NANSENIA* WITH THREE BRANCHIOSTEGAL RAYS

- 1a. Ratio of caudal peduncle length to caudal peduncle depth less than 1.5; vertebrae 35–36 *ahlstromi*
- 1b. Ratio of caudal peduncle length to caudal peduncle depth greater than 1.5; vertebrae 40–42 2

- 2a. Gill rakers on first arch 25–31; predorsal length more than 49 percent of SL *candida*
- 2b. Gill rakers on first arch 35–45, predorsal length less than 49 percent of SL in specimens larger than 50 mm SL 3
- 3a. Vertebrae 42 (eastern South Pacific), 43–45 (Atlantic) *groenlandica*
- 3b. Vertebrae 49–50 *antarctica*

KEY TO SPECIES OF *NANSENIA* WITH FOUR BRANCHIOSTEGAL RAYS

- 1a. Vertebrae 38–39 *pelagica*
- 1b. Vertebrae 41–50 2
- 2a. Predorsal length 49 or more percent of SL 3
- 2b. Predorsal length less than 49 percent of SL 5
- 3a. Length of caudal peduncle more than 12.5 percent of SL and depth of caudal peduncle less than 8 percent of SL with CPL/CPD ratio more than 1.6 *crassa*
- 3b. Length of caudal peduncle less than 12.5 percent of SL and depth of caudal peduncle more than 8 percent of SL with CPL/CPD ratio less than 1.6 4
- 4a. Proximal part of adipose fin densely pigmented; vertebrae 41–42; gill raker count 30–36 *atlantica*
- 4b. Proximal part of adipose fin not pigmented; vertebrae 42–45; gill raker count 28–30 *oblita*
- 5a. Length of caudal peduncle more than 15.2 percent of SL and depth of caudal peduncle less than 6 percent of SL; gill rakers 21–27 6
- 5b. Length of caudal peduncle less than 15.2 percent of SL and depth of caudal peduncle more than 6 percent of SL except in *N. tenuicauda* 7

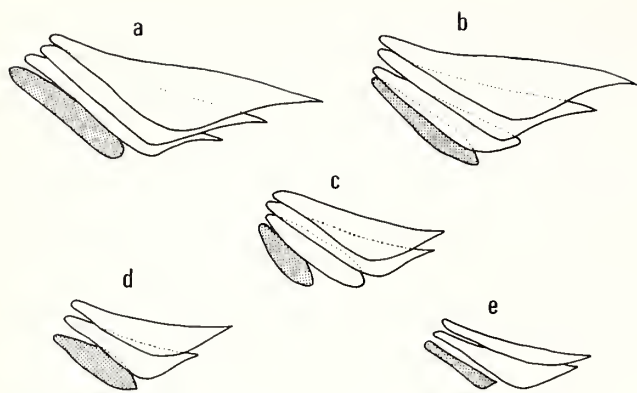


Figure 1. Typical patterns of branchiostegal rays of *Nansenia*. a. *N. ardesiaca*, *N. ahlstromi*, *N. crassa*, and *N. megalopa*; b. *N. pelagica* and *N. atlantica*; c. *N. tenera* and *N. longicauda*; d. *N. antarctica*; e. *N. groenlandica*.

- 6a. Vertebrae 44–45; gill rakers 21–23 *megalopa*
 6b. Vertebrae 47–50; gill rakers 23–27 *longicauda*
 7a. Vertebrae 42–43; gill rakers 43–46 *tenera*
 7b. Vertebrae 46–48; gill rakers 27–42 8
 8a. Gill rakers 27–35; CPL/CPD ratio less than 2.5
 *ardesiaca*
 8b. Gill rakers 38–42; CPL/CPD ratio more than 2.5
 *tenuicauda*

SPECIES WITH THREE BRANCHIOSTEGAL RAYS

Nansenia ahlstromi new species

Figures 2, 21

HOLOTYPE. SIO 57-87 (1, ca. 95 mm, slightly damaged mature female), R/V *Spencer F. Baird*, 29°15'N, 126°07'W, 2240–0730, 14–15 May 1955, 10 ft.—IKMT, 0–754 m.

PARATYPES. SIO 63-425 (1, 38.7), R/V *Horizon*, 27°46'N, 129°14.9'W, 0534–1006, 2 Apr. 1962, 10 ft.—IKMT, 4500 mwo; LACM 43546-1 (1, 32.0), R/V *David Starr Jordan*, 24°00'N, 145°00'W, 2348–0021, 21–22 May 1972, 6 ft.—IKMT 600 mwo; SWFC 7210-24.139 (1, 58.5 decomposed), R/V *David Starr Jordan*, 24°00'N, 139°00'W, 0040–0159, 29 Oct. 1972, 50 ft. universal MWT, 0–494 m.

DIAGNOSIS. Differs from other *Nansenia* in having three branchiostegal rays and 35–36 vertebrae, the least of any known species.

DESCRIPTION. Counts and measurements are based on three juvenile specimens, 32.0–58.5 mm SL. Only the vertebrae were counted for the damaged adult specimen, ca. 95 mm SL. D 8–9; A 7–8; P 12; V 9–11; gill rakers 12 + 28 in two specimens and 11 + 29 in one, total 40; branchiostegal rays three; vertebrae 35 in one specimen, 36 in three specimens. Pyloric caeca not counted due to paucity of specimens. About 30 conical teeth irregularly arranged on head of vomer; about 100 compressed teeth closely set on dentaries in holotype.

Head relatively large compared with body, reflecting the reduced number of vertebrae. Eye large, diameter 2.3–2.9 times in head length in three specimens, 38.7–ca. 95 mm SL.

Head length and eye diameter indicate remarkable allometric growth (Fig. 4). Supraorbital bone damaged and lost in the holotype. Pectoral fin base low, its upper end above ventral margin of body about one-third of the distance between ventral margin and lateral line. Origin of dorsal fin base behind center of body. Ventral fin base below or just behind posterior end of dorsal fin base in the three juveniles, 32.0–58.5 mm SL, but well behind dorsal fin base in the holotype. Adipose fin base over posterior half of the anal fin base.

Tip of lower jaw, anterior part of gular area, and base of adipose fin darkly pigmented in the 38.7-mm SL specimen (SIO 63-425). The same pigment pattern is present in the holotype.

SIZE. The holotype of ca. 95 mm is an adult bearing eggs.

DISTRIBUTION. Restricted to the subtropical eastern North Pacific.

ETYMOLOGY. It is with great pleasure that we name this species *Nansenia ahlstromi* in recognition of the contributions of the late Elbert Halvor Ahlstrom to our knowledge of pelagic fishes.

Nansenia candida Cohen, 1958

Figures 3, 4, 22

Nansenia candida Cohen, 1958:52–54, fig. 1 (orig. descr.) Eastern North Pacific.

?*Nansenia sanrikuensis* Kanayama and Amaoka, 1983:77–79 (orig. descr.) Western North Pacific.

MATERIALS. CAS 51023 (1, alizarin specimen dissected), one of the paratypes, R/V *Hugh M. Smith*, 41°39'N, 139°02'W, 30 May 1956, from the stomach of *Alepisaurus* sp.; OSU 8, 9 (2, 46.4, 80.7), 49°16'N, 132°42'W, 0–60 m; OSU 10, 12 (2, 44.0, 136.9), 41°59.5'N, 126°30.6'W, 0–200 m; OSU 11 (1, 150.5), 44°37.3'N, 125°17.3'W, 1500–500 m; OSU 960 (1, 150.5), 44°37.3'N, 125°38.0'W, 0–200 m; OSU 1132, 1133 (2, 79.0, 72.2), 44°25'N, 129°35'W, 0–75 m; OSU 1166 (1, 32.1), MT-648, 44°16'N, 125°15'W, surface tow, 40 mwo; OSU 1170 (1, 23.5), MT-652, 44°31'N, 125°17'W, 0–1400 m; OSU 1191 (2, 95.8, 99.6), MT-757, 44°38'N, 128°35'W, 0–210 m; OSU 1212 (1, 140.0), 44°39.8'N, 125°00'W, 0–200 m; OSU 1216 (1, 108.2), MT-749, 44°39'N, 125°36'W, 0–200 m; OSU 1217 (1, 60.3), MT-727, 44°39'N, 128°00'W, 0–1000 m; OSU 2003 (1, 179.2), haul 2054, 44°49.7'N, 125°34.0'W, 0–600 m; OSU 2388 (1, 129.1), MT-2398, 44°39'N, 125°29'W, 0–500 m; USNM 197380 (1, 60.5), 20 miles southeast of San Clemente Is., California, spit up by albacore; USNM 195874 (1, 122), sta. BB-76, North Pacific, 0–30 m; USNM 195875 (1, 75.5), sta. BB-176, 48°03'N, 134°20'W; USNM 195876 (1, 156), sta. BB-199, 49°15.6'N, 145°56.7'W, 100 mwo; SIO 66-51-9F (1, 24), 40°35'N, 125°51.5'W; SIO 55-73-9A (1, ca. 64, damaged), 39°01'N, 165°10'W, from *Alepisaurus* stomach; UBC 65-607 (2, 75.5, 81.0) and UBC 65-609 (2, 76.5, 87.5), off Queen Charlotte Sound, B.C., Canada; UBC 65-610 (16, 76.0–88.0) and UBC 65-615 (1, 77.5), off Queen Charlotte Sound; UBC 65-623 (16, 118.0–187.0), 52°11'N, 133°11'W; UBC 65-524 (1, 121.0), 52°13'N, 133°12'W; LACM 34258-1 (2, 63–71),



10 mm

Figure 2. *Nansenia ahlstromi*. Paratype, SIO 63-425, 38.7 mm SL.

R/V *Alaska*, off San Clemente Is., California; LACM 9006-23 (1, 35), R/V *Velero*, Catalina Basin off California.

DIAGNOSIS. Differs from other *Nansenia* in the following combination of characters, three branchiostegal rays and 26–31 gill rakers on the first arch. Vertebral counts higher (44–47) in *N. candida* than in *N. ahlstromi* (35–36).

DESCRIPTION. D 9–10; A 8–9; P 10–11 (rarely 9); V 9–10 (rarely 11); gill rakers 8–11 + 1 + 17–20, total 26–31 with 26 in one specimen, 27 in five, 28 and 29 in three respectively,

30 in one and 31 in three; branchiostegal rays 3; vertebrae 44–47 with 44 in two specimens, 45 in five, 46 in eight and 47 in two. The above counts are based on 18 specimens, 46.2–179.2 mm SL. Pyloric caeca seven in two specimens, nine in one. About 12–21 conical teeth on head of vomer, about 80–100 teeth on dentaries, resembling a closely spaced picket fence, in three specimens more than 130 mm SL.

Body slender, moderately compressed, with body depth to width ratio 1.5–1.7. Eye diameter 3.0 to 3.4 times in head



10 mm

Figure 3. *Nansenia candida*. OSU 2003, mature female, 179.2 mm SL.

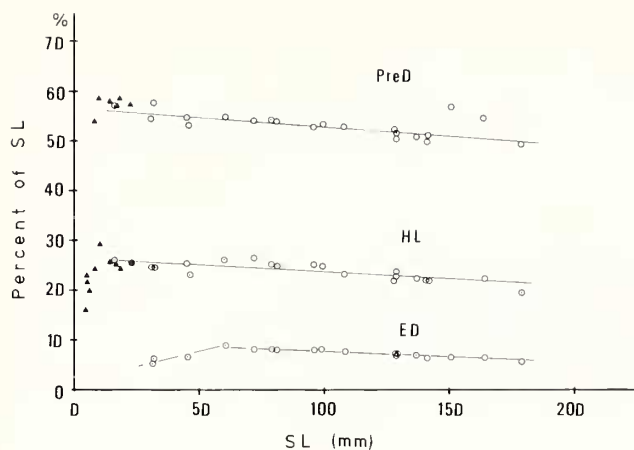


Figure 4. *Nansenia candida*. Predorsal, head lengths, and eye diameter in relation to standard length. Triangles indicate the values for postlarvae and young juveniles smaller than 23 mm SL.

length, viewed laterally, its dorsal margin (supraorbital bone) touching or slightly higher than dorsal margin of head, yellowish iridescent pigment, roughly crescent-shaped, present in the posterior half of iris. Aphakic space developed, its horizontal space nearly equal to width of anteriormost part of iris, and about half the width of its posterior part. Aphakic space less well developed in juveniles smaller than 100 mm SL. Allometric growth in head length, eye diameter and predorsal length is shown in Figure 4.

Upper end of pectoral fin base on midpoint between lateral

line and ventral margin of body, or slightly lower; its lower end separated from ventral margin of body by a distance more than length of pectoral fin base. Dorsal fin originating behind center of body. Ventral fin base below posterior part of dorsal fin. Origin of anal fin slightly in advance of adipose fin. Skin around the anterior end of adipose and caudal fin bases densely pigmented. Body color in formalin preserved specimens brown. However, Cohen (1958) noted that in life the entire fish is probably a bright silver.

SIZE. The largest specimen examined, 179.2 mm SL, had mature ovaries.

DISTRIBUTION. *Nansenia candida* has been collected in the subarctic eastern Pacific east of 170°W between 35°N and 55°N and in the California Current region north of 30°N (Fig. 22).

REMARKS. Kanayama and Amaoka (1983) described *Nansenia sanrikuensis* based on two large adult specimens, 206.0 and 238.8 mm SL. This species is closely related to *N. candida*, and both species occur in the subarctic North Pacific. But *N. candida* has been reported only from the eastern part of the Pacific between the latitude of southern California and Canada, and *N. sanrikuensis* was collected in the western Pacific off northern Honshu, Japan. Kanayama and Amaoka (1983) reported that *N. sanrikuensis* differs in having a smaller eye (4.8–5.8 vs. 8.3–9.6 percent of SL), shorter snout (3.5–3.6 vs. 5.1–5.8), lower gill raker counts (25–27 vs. 30) and higher vertebral counts (48–49 vs. 44–47). Their proportional data and gill raker counts for *N. candida* are based on the original description by Cohen (1958) which was taken from three specimens, 54.4–72.4 mm SL,



Figure 5. *Nansenia groenlandica*. ISH 194-59, 112.5 mm SL.

for measurements and five for meristic counts. However, their vertebral counts are based on the present study. Specimens studied by Kanayama and Amaoka (1983) and Cohen (1958) differ greatly in size. In the present study we found considerable allometric growth in eye diameter, snout length, and head length of *N. candida*. We conclude that proportions of snout, eye, and head are invalid for distinguishing the two species. The ranges of gill raker counts are also overlapping between the two (25–27 vs. 26–31) as *N. candida* has a wider range than Cohen (1958) described. At present only vertebral counts (48–49 vs. 44–47) separate these species. Considering the adjacent ranges, the paucity of specimens of *N. sanrikuensis* and the possibility of a geographical cline, the status of *N. sanrikuensis* is questionable.

Nansenia groenlandica (Reinhardt, 1840)

Figures 5, 6, 21

Microstomus grönlandicus Reinhardt, 1840:8 (orig. descr. Fiskeneset, Greenland).

Nansenia groenlandica: Jordan and Evermann, 1896:528; Schmidt, 1918:12, figs. 1–12; Cohen, 1964:24, fig. 8.

MATERIALS. Atlantic: ISH 21/75 (2, 57.0–67.0), FFS *Walther Herwig* sta. 10-1/75, 41°18'N, 27°49'W, 0–117 m; ISH 29/75 (1, 32.5), FFS *Walther Herwig* sta. 14-1/75, 41°26'N, 27°09'W, 0–183 m; ISH 194/59 (1, 112.5), FFS *Anton Dorn* sta. 3257/59, 61°48'N, 13°08'W, 0–1400 m; ISH 314/73 (2, 132.0, damaged), FFS *Walther Herwig* sta. 678/73, 65°09'N, 32°50'W, 0–1100 m; ISH 448/73 (8, 60.5–103.5), FFS *Walther Herwig* sta. 693/73, 57°55'N, 28°23'W, 0–415 m; ISH 473/73 (1, 89.0), FFS *Walther Herwig* sta. 693/73, 56°28'N, 26°44'W, 0–2500 m; ISH 540/73 (3, 80.0–108.0), FFS *Walther Herwig* sta. 696/73, 55°39'N, 25°47'W, 0–2500 m; ISH 540/73 (3, 80.0–108.0), FFS *Walther Herwig* 696/73, 55°39'N, 25°47'W, 0–410 m; ISH 748/73 (1, 57.0), FFS *Walther Herwig* 707/73, 50°03'N, 19°39'W, 0–255 m; USNM 186071 (damaged, head only), M/V *Delaware*, 40°34'N, 64°07'W, from stomach of *Makaira*; USNM 221368 (3, damaged, ca. 63–84), FFS *Walther Herwig* sta. 695/73, 55°43'N, 25°53'W, 0–2600 m. Pacific: LACM 11292 (1, 63.7), R/V *Eltanin* sta. 1972, 39°34'S, 127°18'W, IKMT, 0–4493 m; LACM 10288 (2, damaged, ca. 30), R/V *Eltanin* sta. 190, 34°51'S, 74°04'W, 0–1580 m.

DIAGNOSIS. Differs from other *Nansenia* in having three branchiostegal rays, 42–45 vertebrae (43–45 in the Atlantic, 42 in Pacific specimens), and 37–45 gill rakers on the first arch.

DESCRIPTION. D 9–10; A 8–10; P 11–13; V 11–12 (rarely 10); gill rakers 12–15 + 1 + 23–29, total 37–45 with 37(2), 38(5), 40(1), 41(2), 42(1), 44(2), and 45(1); branchiostegal rays three; vertebrae 42(1) in the South Pacific, 43–45 with 43(8), 44(9), and 45(1) in the North Atlantic. Counts are based on 19 specimens, 48.0 to 132.0 mm SL. Pyloric caeca seven and eight in two specimens; 20–22 conical teeth irregularly arranged on vomer, 50–65 teeth closely set on dentaries in four specimens.

Body slender, body depth–width ratio ranges from 1.0–1.2. Eye large, its diameter 2.5 to 2.8 times in head length.

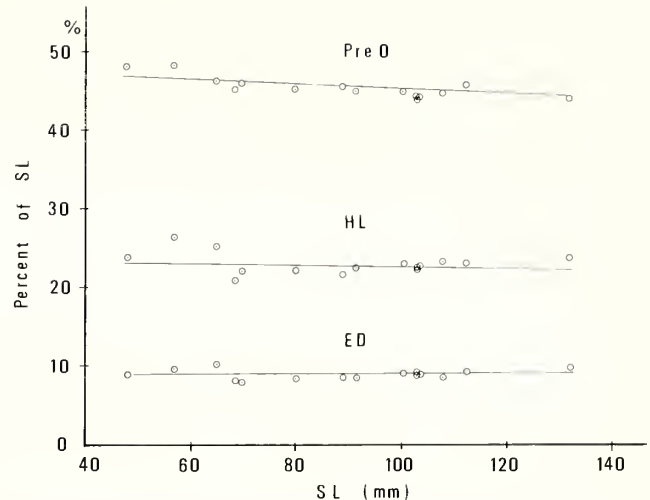


Figure 6. *Nansenia groenlandica*. Predorsal, head lengths, and eye diameter in relation to standard length.

Viewed laterally, about one-third of eye circumference protruded above the dorsal margin of the head. White or yellowish tissue developed over posterior half of iris, sometimes covering whole iris. Aphakic space slightly developed anteriorly, its horizontal space nearly equal to half to two-thirds width of the anterior part of iris. Aphakic space less well developed in juveniles smaller than 100 mm SL.

Upper end of pectoral fin base separated from ventral margin of body by one-third of distance between lateral line and ventral margin or slightly higher; its lower end above ventral margin by a space more than the length of pectoral fin base. Dorsal fin originating in front of center of body. Ventral fin base below posterior end of dorsal fin base or just behind it. Adipose fin base above last two anal fin rays. No remarkable inflection in allometric growth for specimens between 48 and 132 mm SL (Fig. 6).

Skin around adipose fin base uniformly pigmented compared to the lateral body surface. Caudal fin base and posterior part of caudal peduncle densely pigmented, sparser in specimens larger than 100 mm SL. Body of preserved specimens usually brown or light brown, some with remains of guanine. The entire body surface of the ISH 194-59 specimen, although all scales had come off, is covered with guanine. This specimen may have been preserved in alcohol.

SIZE. The badly damaged specimen (caudal segment missing) taken from a marlin stomach, USNM 186071, identified as *N. groenlandica* only by its branchiostegal ray count and locality, is a mature male and its standard length can be estimated as about 180 mm based on its head length. The largest four intact specimens, 103.0 to 132.0 mm, collected in September have undeveloped gonads.

DISTRIBUTION. This species occurs widely in the arctic and subarctic waters of the North Atlantic Ocean. The southern limit of its distribution is near 40°N. Present results agree well with the work of Schmidt (1918) in the eastern North Atlantic. Three specimens collected in the subantarctic or

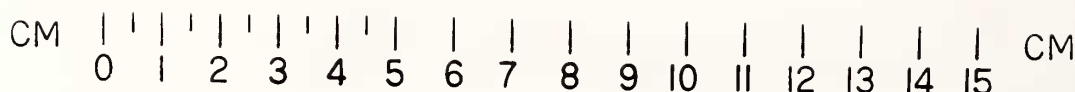


Figure 7. *Nansenia antarctica*. LACM 10875 (one of the three catalogued), 198.9 mm SL, holotype.

transitional waters of the eastern South Pacific show no morphological difference from the Atlantic specimens, but have slightly fewer vertebrae. Mukhacheva (1972) reported a similar distribution pattern for the midwater fish, *Gonostoma bathyphilum*, which is widely distributed in the North Atlantic between 30°N and 60°N, the South Atlantic south of 30°S, and also in the eastern South Pacific south of 30°S.

Nansenia antarctica new species

Figures 7, 8, 21

HOLOTYPE. LACM 10875 (one of three), 198.9 mm SL, R/V *Eltanin* sta. 1204, 55°57'S, 159°23'W, 0560–1035, 10 Aug. 1964, IKMT, 0–4145 m.

PARATYPES. LACM 10875 (two of three) (2, 197.8–207.5), collection data as for holotype. LACM 10658-15 (2, 79.2–225.0), R/V *Eltanin* sta. 858, 64°42'S, 78°34'W, 1905–

0030, 17–18 Nov. 1963, IKMT; USNM 247255 (1, 158.6), R/V *Eltanin* cr. 35, sta. 2300, 52°00'S, 124°02'E, 20 Sep. 1968, IKMT, 0–750 m (bottom depth 3914–4362 m).

OTHER MATERIALS. LACM 11194 (2, 98.9–108.9), R/V *Eltanin* sta. 1661, 61°30'S, 108°26'W, 0134–0430, 26 Apr. 1966, IKMT, 0–5036 m; LACM 11212 (1, 49.9), R/V *Eltanin* sta. 1686, 57°39'S, 115°12'W, 1255–1540, 6 May 1966, IKMT, 0–4286 m; USNM 247254 (7, 31.0–35.0), R/V *Eltanin* cr. 21, sta. 20G, 0–850 m; ISH 688/71 (1, 112.5), FFS *Walther Herwig* sta. 363-III/71, 40°18'S, 39°04'W, 8 Mar. 1971, 0–800 m; ISH 542/71 (1, 118.2), FFS *Walther Herwig* sta. 354-II/71, 39°19'S, 48°09'W, 6 Mar. 1971, 0–ca. 2000 m.

DIAGNOSIS. Differs from other *Nansenia* in having three branchiostegal rays, 47–50 vertebrae, and 35–41 gill rakers.

DESCRIPTION. D 9–10; A 9–10; P 12–14; V 11–12; gill rakers 10–13 + 1 + 23–27, total 35–41 with 35(2), 37(2), 38(2), 39(2), and 41(1); branchiostegals three; vertebrae 49–50 with 49(3) and 50(5). Pyloric caeca seven in one specimen; 27 irregularly arranged conical teeth on head of vomer and about 75 compressed teeth on dentaries on one specimen of 207.5 mm SL.

Body slender, anterior part slightly compressed in specimens larger than 190 mm, subcylindrical in smaller specimens. Caudal peduncle more compressed than anterior part of body. Body depth–width ratio 1.1–1.7. Eye large, diameter 2.4–2.9 times in head length, with its dorsal margin protruding slightly above margin of head. Golden pigment, roughly crescent-shaped, on posterior half of iris. The ratio of width of the posterior part of iris to that of the anterior part is between two and four, whereas the ratio is less than two in other species having three branchiostegal rays. Aphakic space extremely well developed in front of lens (some-

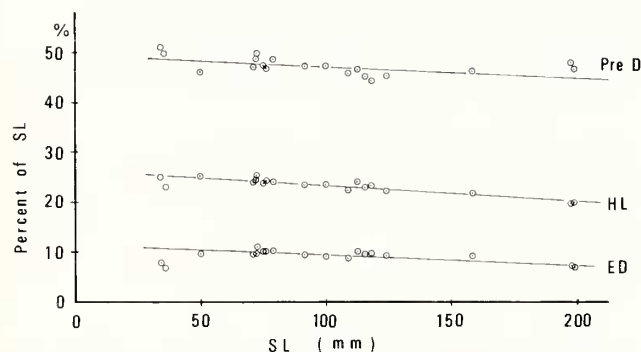


Figure 8. *Nansenia antarctica*. Predorsal, head lengths, and eye diameter in relation to standard length.

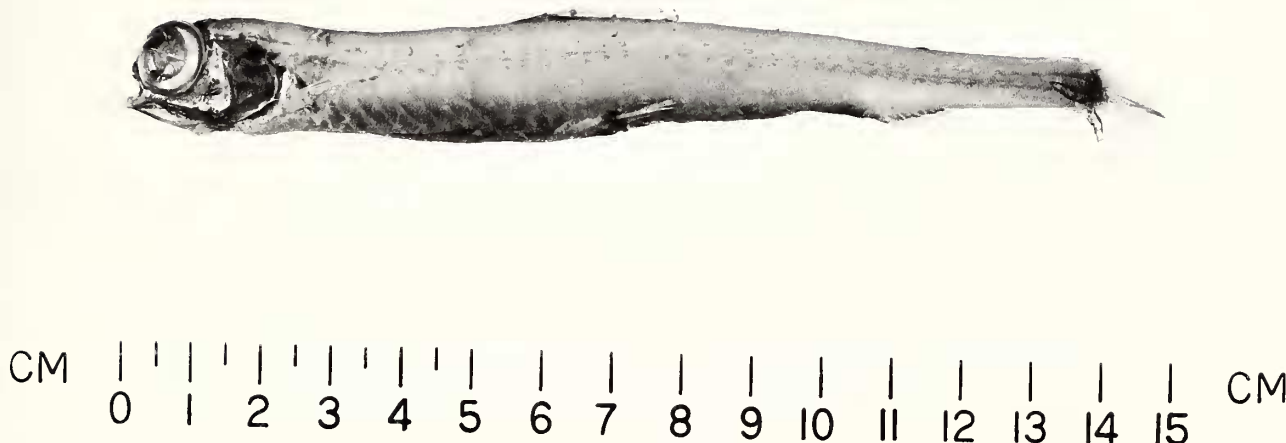


Figure 9. *Nansenia megalopa*. ISH 2013-71 (one of the two catalogued), 133.0 mm SL, holotype.

times lens placed anteriorly), its horizontal space usually three to four times as wide as the width of the iris at the anteriormost part, in specimens larger than 100 mm SL. This space is less well developed in smaller juveniles.

Upper end of pectoral fin base just below midpoint between the lateral line and ventral margin of body, its lower end separated from the ventral margin by a distance 1.8–3.0 times as long as its base. Origin of dorsal fin base in front of the center of the body. Ventral fin base just below the posterior end of the dorsal fin base. Adipose fin base above the posterior half of anal fin base.

Skin badly abraded in most specimens, light brown in alcohol. Dark colored scale pockets, which are extremely fragile, a few sometimes remaining along lateral line and the dorsal and ventral sides of body. Caudal and adipose fin bases usually slightly pigmented.

SIZE. The largest specimens studied, 207.5 mm, had mature ovaries with developing eggs.

DISTRIBUTION. This species occurs in the southern part of the subantarctic region between the antarctic and subtropical convergences of the Pacific (Fig. 21). Its distribution probably extends northward to the subtropical convergence in the Atlantic sector.

ETYMOLOGY. Named for its region of occurrence.

SPECIES WITH FOUR BRANCHIOSTEGAL RAYS

Nansenia megalopa new species

Figures 9, 21

Nansenia sp. 2 (?), Parin and Golovan, 1976:251–252, fig. 2, 04°10'N, off west Africa, 0–510 m.

HOLOTYPE. ISH 2013 a/71, 133.0 mm, FFS *Walther*

Herwig sta. 463-III/71, 08°11'S, 14°12'W, 8 Apr. 1971, 0–640 m.

PARATYPES. ISH 1730/71 (1, 126.5), FFS *Walther Herwig* sta. 447-III/71, 18°36'S, 04°18'W, 4 Apr. 1971; ISH 2013b/71 (1, 108.5), FFS *Walther Herwig* sta. 463-III/71, 08°11'S, 14°12'W, 8 Apr. 1971, 0–640 m; ISH 2491/71 (1, 139.5), FFS *Walther Herwig* sta. 486-III/71, 07°32'N, 20°54'W, 14 Apr. 1971, 0–ca. 1300 m; UF 29912 (1, 126.0), R/V *Geronimo* cr. 2, sta. 82, 03°28'S, 00°14'W, Gulf of Guinea, 6 Aug. 1963, 0–710 m.

DIAGNOSIS. Differs from other *Nansenia* in having four branchiostegal rays, 44–45 vertebrae and 21–23 gill rakers on the first arch. This species is also separable from all other *Nansenia* by having a very large eye, eye diameter to snout length ratio >2.8 to 1.

DESCRIPTION. D 9–10; A 8–10; P 12–13; V 9–10; gill rakers 6–7 + 1 + 14–15, total 21–23 with 21(1), 22(2), and 23(2); branchiostegal rays four; vertebrae 44–45 with 44(3) and 45(2).

Pyloric caeca not counted; teeth on head of vomer, usually embedded in the tooth ridge and often indiscernible; 35–50 teeth on both dentaries.

Body slender and subcylindrical, body depth to width ratio 1.2–1.4 in specimens of 108.5–139.5 mm SL. Eye large, its diameter 2.1 to 2.4 in head length. A roughly crescent-shaped, silvery pigment patch on the posterior half of the iris; pupil elliptical with a large aphakic space in front of the lens. Upper end of pectoral fin base around midpoint between lateral line and ventral margin of body. Dorsal fin base originating in front of center of body. Ventral fin base below posterior end of dorsal fin base. Adipose fin origin above posterior third of anal fin base. Bases of ventral and adipose fins densely pigmented.

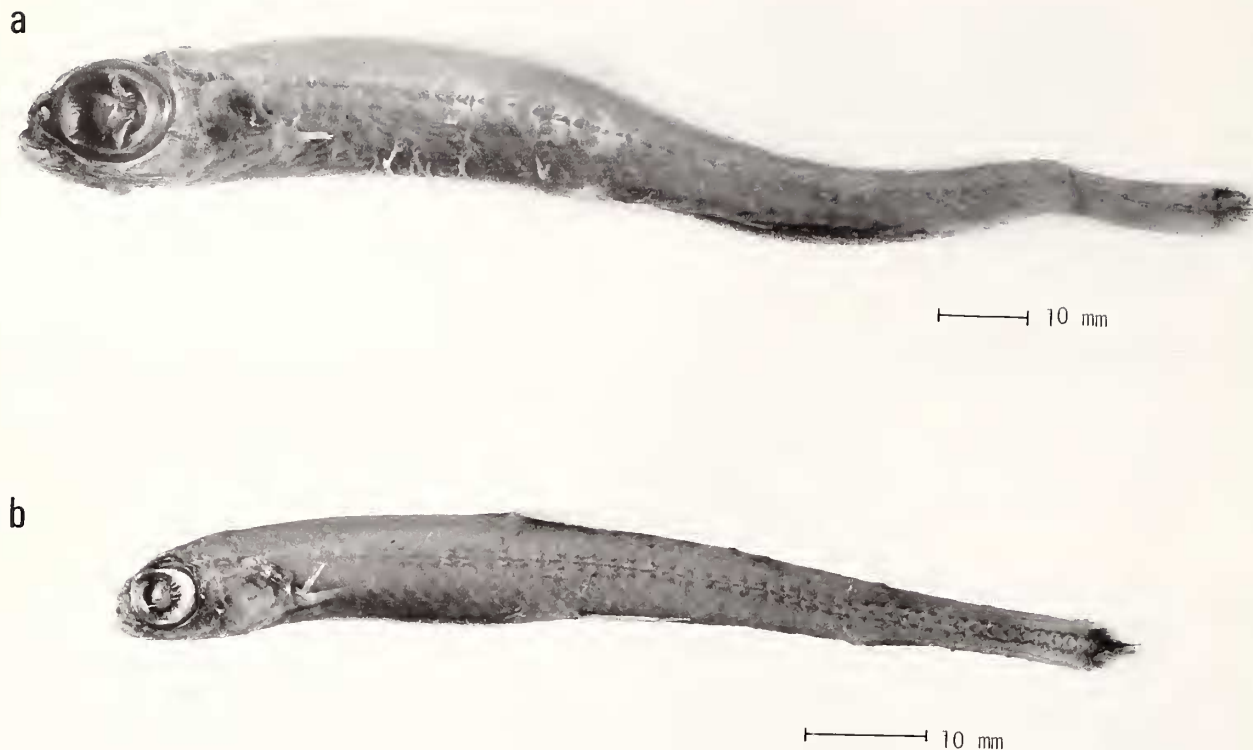


Figure 10. *Nansenia longicauda*. a. SIO 76-7-9, 133 mm SL, holotype; b. ISH 60-66, 78.0 mm SL, paratype.

SIZE. A specimen of 126.5 mm SL has ripe ovarian eggs.

DISTRIBUTION. All specimens were collected in the oceanic area of the tropical Atlantic between 10°N and 20°S.

ETYMOLOGY. *Nansenia megalopa* from Greek *megale*, great, and from *ops*, eye, referring to the extraordinarily large eye.

Nansenia longicauda new species

Figures 10, 11, 22

HOLOTYPE. SIO 76-9, 133.0 mm, 30°37.0'N, 147°24.0'W, 2027–2350, 10 Nov. 1971, IKMWT, 1800 mwo.

PARATYPES. Pacific: USNM 207530 (1, 104.6), Univ. of Hawaii, samp. no. 71-2-11, 21°20'N, 158°20'W, 28 Feb. 1971, 610–650 m; USNM 215703 (1, 97.2), R/V *Townsend Cromwell*, CR-52, sta. 16, 21°32.7'N, 158°21.8'W, 0355–1100, 12 Feb. 1971. Atlantic: ISH 60/66 (1, 78.0), FFS *Walther Herwig* sta. 177–66, 33°45'N, 16°00'W, 10 May 1966, MT1600, 0–600 m.

OTHER SPECIMENS EXAMINED. Pacific specimens: SIO 71-300 (1, 65.0), R/V *Thomas Washington* sta. Aries

9-H7, 27°24.5'N, 155°25.5'W, 0720–1100, 30 Sep. 1971, 10ft.—IKMT, 3000 mwo; USNM 207531 (1, 46.5), Univ. of Hawaii, samp. no. 71-6-10, 21°00'N, 158°20'W, 10 Jun. 1971, 560–600 m; USNM 215470 (1, 67.0), R/V *Townsend Cromwell*, samp. no. 73-8-29, 21°20'N, 158°20'W, 0745–

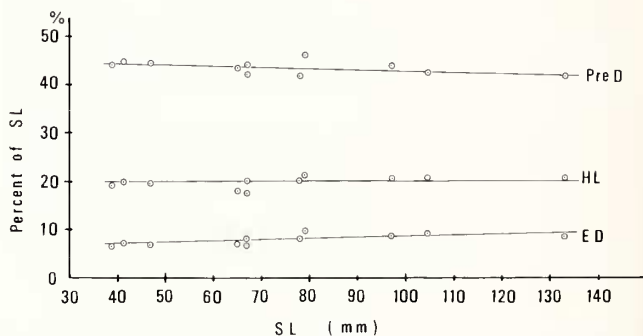


Figure 11. *Nansenia longicauda*. Predorsal, head lengths, and eye diameter in relation to standard length.

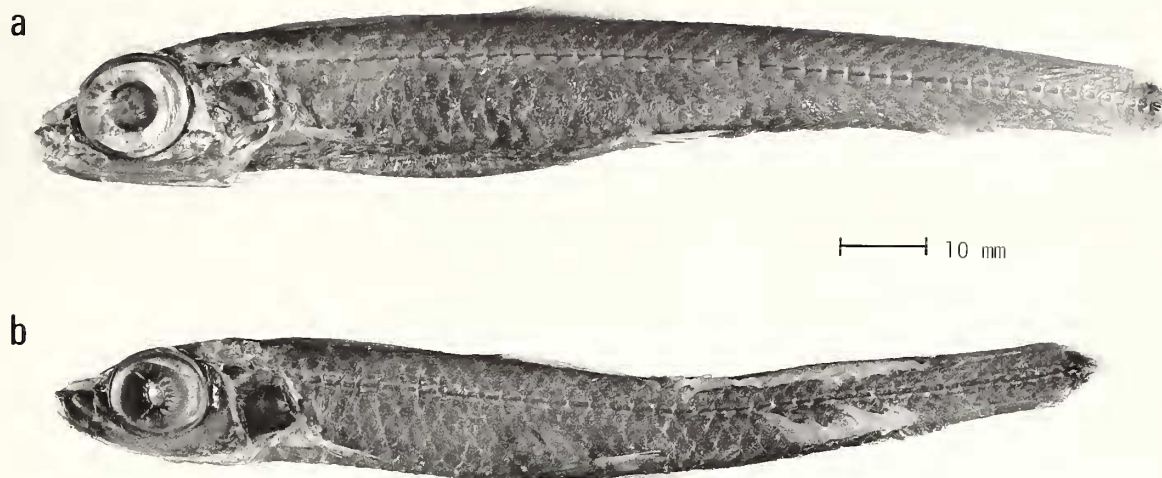


Figure 12. *Nansenia tenera*. a. ZMUC P19621-23 (one of the three cataloged), 129.0 mm SL, holotype; b. ISH 540-73, 117.0 mm SL, paratype.

1054, 29 Aug. 1973, 400–1100 m; SIO 71-302 (1, 67.0), R/V *Thomas Washington* Aries 9-H9, 27°24.5'N, 155°25.5'E, 30 Sep. 1971. Atlantic specimens: USNM 246799 (1, 41.5), Acre 6-22; USNM 246800 (1, 39.1), Acre 9-24. Both specimens were collected around 38°18'N and 64°12'W.

DIAGNOSIS. Differs from other *Nansenia* in having four branchiostegal rays, 23–27 gill rakers on the first arch, 47–50 vertebrae and a slender caudal peduncle, the least depth of which is 4.3–5.6 percent of SL. The body shape of this species resembles that of *N. megalopa*. Higher gill raker counts (23–27 vs. 21–23), higher vertebral counts (47–50 vs. 44–45) and longer snout (2.3–4.1 vs. 2.3–2.9 percent of SL) separate *N. longicauda* from *N. megalopa*.

DESCRIPTION. D 10 (rarely 11); A 10–11 (rarely 9); P 13–14 (rarely 11); V 10–11 (rarely 9); gill rakers 7–8 + 1 + 15–18, total 23–27 with 23(1), 24(4), 25(2), and 26(2); branchiostegal rays four; vertebrae 47–50 with 47(1), 48(1), 49(5), and 50(4). These counts are based mainly on 11 specimens, 39.1–133.0 mm SL. Pyloric caeca not counted. Irregularly sized and arranged conical teeth on head of vomer, which are embedded deeply in tooth ridge, about 24; compressed teeth closely set on dentaries, about 50 in a 104.6-mm specimen.

Body slender and subcylindrical with body depth to width ratio 1.3–1.6 in specimens larger than 45 mm SL. The ratio is larger in smaller specimens. Eye very large, indicating considerable allometric growth (Fig. 11); its diameter varying linearly from 6.4 percent of SL in a 39.1-mm specimen to 8.8 percent in a 133.0-mm specimen; eye diameter 2.2–2.6

times in head length in specimens larger than 50 mm, and 2.7–3.0 times in a specimen smaller than 50 mm.

Dorsal margin of eye protruding above dorsal margin of head in a specimen larger than 100 mm SL. Pupil oval, with aphakic space developed anteriorly. Base of uppermost pectoral fin at or slightly higher than midpoint between lateral line and ventral margin of the body. Origin of dorsal fin base well behind center of body. Predorsal length less than 47 percent of standard length with smaller values in larger specimen due to allometric growth (Fig. 11). Base of outermost ventral fin below or just behind posterior end of dorsal fin base. Adipose fin base just in front of vertical through center of anal fin base.

Tip of snout, upper jaw, anterior part of gular area, bases of ventral and caudal fins densely pigmented.

SIZE. The largest specimen is the 133.0-mm SL holotype.

DISTRIBUTION. *Nansenia longicauda* occurs in the subtropical and temperate waters of the Pacific and Atlantic oceans. Based on collection data, this species appears to be an oceanic mesopelagic species (Fig. 22).

ETYMOLOGY. The specific name is derived from Latin, *longus* meaning long and *cauda* meaning tail referring to the long and slender caudal peduncle.

Nansenia tenera new species

Figures 12, 21

HOLOTYPE. ZMC P19621-23 (1, 129.0), Dana sta. 3975-I, 35°42'S, 18°37'E, 31 Jan. 1930, 3000 mwo.

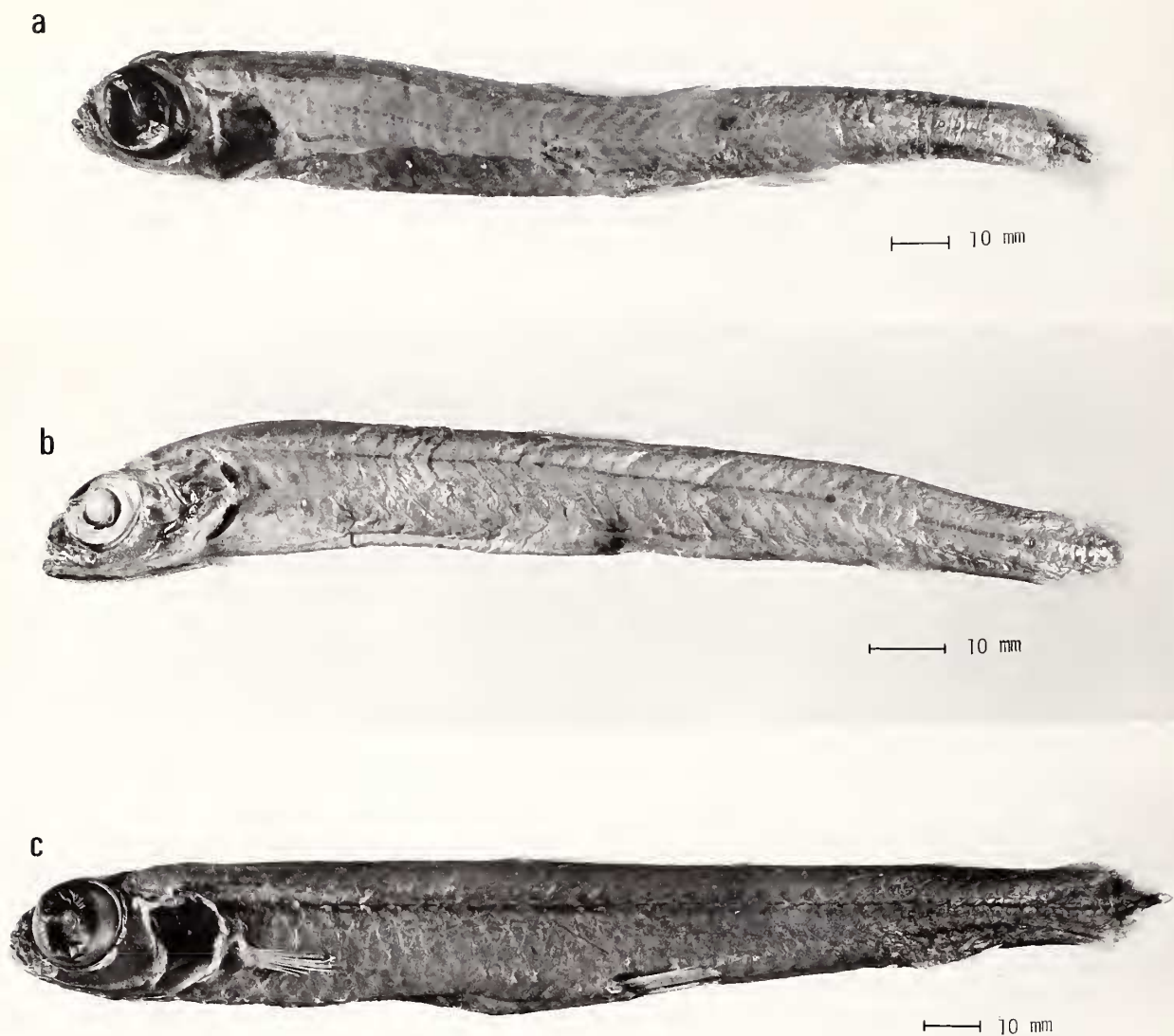


Figure 13. *Nansenia ardesiaca*. a. FMNH 57086, 164.5 mm SL, holotype from off Japan; b. USNM 93354, 136.0 mm SL, one of the seven paratypes of *N. schmitti* from off the Philippines; c. ZMUC P19624-25, 183.5 mm SL, from off the northeast coast of South Africa.

PARATYPES. ZMC P19621-23 (2, 112.0–117.4), collection data as for the holotype; ZMC not catalogued (1, 105.6), Dana sta. 3975-II, 35°42'S, 18°37'E, 31 Jan. 1930, 2500 mwo; ISH 1009/73 (1, 117.0), FFS *Walther Herwig* 696-73, 55°39'N, 25°42'W, 22 Sep. 1973, 400–410 m; ISH 829/71 (1, 101.0), FFS *Walther Herwig* 376/71, 39°55'S, 26°02'W, 11 Mar. 1971, 0–2000 m.

DIAGNOSIS. Differs from other species of *Nansenia* in having four branchiostegal rays, 42–43 vertebrae, and 43–46 gill rakers.

DESCRIPTION. D 11–12; A 8–9; P 11–12; V 11–12; gill rakers 13–15 + 1 + 28–32, total 43–46 with 43(1), 44(3), 45(1), and 46(1); branchiostegal rays four; vertebrae 42 in one North Atlantic specimen, 43 in the five South Atlantic specimens. Pyloric caeca 7–9 in three specimens; about 16 conical teeth irregularly arranged on head of vomer; about 60 compressed teeth on dentaries in a 112-mm specimen.

Eye large, its diameter 2.4–2.7 in head length; nearly one-third to one-quarter of eye protruding above the dorsal margin of head. A golden colored, crescent-shaped pigment on



Figure 14. *Nansenia tenuicauda*. ISH 1010-71, 69.0 mm SL, paratype.

posterior half of iris. Aphakic space developed; pupil acorn-shaped with tip anteriorly directed. This type of pupil was not observed in any other species.

Upper end of pectoral fin base below midpoint between lateral line and ventral margin of body; its lower end above ventral margin of body by a space greater than length of pectoral fin base. Dorsal fin originating in front of center of body. Ventral fin base above posterior half of anal fin base in the South Atlantic specimens, but above the midpoint in one specimen from the North Atlantic.

Body color of preserved specimens light brown. The entire body surface of three specimens, especially the ventral side, is sparsely covered with guanine, which resembles silver powder. Caudal fin base densely pigmented in the specimens from the South Atlantic, but the pigmentation extends forward becoming sparser anteriorly in the North Atlantic specimen.

SIZE. A specimen of 112.0 mm SL has maturing gonads.

DISTRIBUTION. Five specimens were collected in the South Atlantic between 35°S and 39°S, and one specimen from the subarctic region of the North Atlantic (55°39'N).

ETYMOLOGY. The specific name *tenera* is from Latin, soft, referring to the consistency of the body.

Nansenia ardesiaca Jordan and Thompson, 1914
Figures 13, 22

Nansenia groenlandica: Tanaka, 1911:15–16, pl. III, fig. 13 (non Reinhardt, 1840) (Sagami Bay, Japan).

Nansenia ardesiaca Jordan and Thompson, 1914:210–211, pl. XXIV, fig. 2 (orig. descr., off Japan).

Nansenia tanakai Schmidt, 1918:15 (orig. descr. Japan).

Bathymacrops microlepis Gilchrist, 1922:53–54, pl. IX, fig. 2 (orig. descr., east coast of South Africa).

Microstoma (Euproserpa) schmitti Fowler, 1934:256–257, fig. 18 (orig. descr. Philippines).

Nansenia macrolepis: Cohen, 1958:56 (east coast of South Africa).

Nansenia robusta Abe, 1976:27–31, figs. 1–6 (orig. descr. South China Sea).

MATERIALS. Off Japan: FMNH 57086, 164.5 mm SL, Okinose, Sagami Bay, central Japan (holotype of *N. ardesiaca*); KYO 4434 (2, 157.5, 144.0), southern Japan, KU 7013 (1, 120.0), Mimase fish market, Shikoku Is., Japan; KU 13012 (1, 141.5), Tosa Bay, Shikoku Is., 430–460 m; KU 13125–13130, 13243, 13244, 13279 (9, 124.0–155.0), 15 km east of Ashizuri Misaki Pt., Shikoku Is., bottom trawl 420–555 m.

Southeast Asian Seas: USNM 92327 (holotype of *N. schmitti*) (1, 194.5), R/V *Albatross*, sta. D5445, Atalaya Pt., Batag Is., off Samar, the Philippines, 3 Jun. 1909; USNM 93354 (1, 136.0), R/V *Albatross*, sta. 5589, 04°12.10'N, 118°38.08'E, Mabul Is., off the Philippines (one of seven paratypes of *N. schmitti*); KU 15792 (1, 88.5, damaged), R/V *Hakuho Maru*, Cr. KH72-1, sta. 20, 05°40.9'N, 119°46.3'E, bottom trawl 460–500 m; KU 16644 (1, 207.0), R/V *Hakuho Maru*, KH72-1, sta. 26, 09°27.0'S, 127°58.6'E, Timor Sea, bottom trawl 690–850 m.

Off South Africa: USNM 2034391-10 (10, 174.0–192.0), R/V *Anton Bruun*, 22°25'S, 35°54'E, shrimp trawl, 0–740 m; ZMC P19624-25 (2, 183.5, 185.0), *Galathea* exped. 1950–1952, sta. 203, 25°36'S, 35°21'E off Natal, 2015 m; USNM not catalogued, SOSC ref. no. 1701-2 (2, 150.0, 165.0), IIO Exped. R/V *Anton Bruun*, Cr. no. 8, sta. 397C, 26°07'S, 34°11'E, bottom trawl 600–665 m; CAS-SU-31501 (1, 127.5), off South Africa.

DIAGNOSIS. Differs in having four branchiostegal rays, predorsal length less than 49 percent of SL, length of caudal peduncle not more than 15 percent of SL, number of gill rakers on first arch 27–35.

DESCRIPTION. D 9–10; A 9–10; P 12–14 (rarely 11); V 11 (rarely 10, 12); gill rakers 9–11 + 1 + 19–23, total 29–35 with 29(1), 30(1), 31(1), 32(5), 34(2), and 35(2) in 12 specimens from off Japan; 9 + 1 + 18–21, total 27–31 with

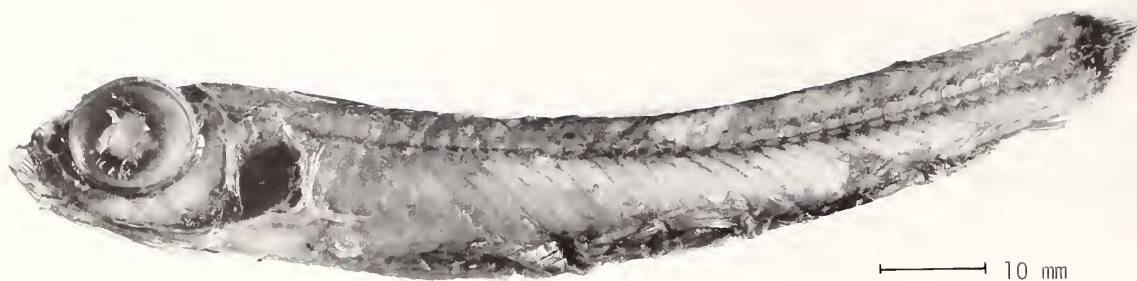


Figure 15. *Nansenia pelagica*. ISH 649-74, 102.0 mm SL, holotype.

27(1), 30(1), and 31(1) in three specimens from off the Philippines; 8-10 + 1 + 19-21, total 28-31 with 28(1), 29(2), 30(7), and 31(4) in 14 specimens from off South Africa; branchiostegal rays four; vertebrae 46-48 with 46(6), 47(12), and 48(2).

Gill raker counts were rather variable and higher on the average in the specimens from off Japan. Ranges of these counts, however, overlap among specimens from the three different regions. No significant geographical variation was found in other counts and measurements.

Pyloric caeca 8, 8, and 9 in three specimens from off South Africa, and 7, 9, and 9 in two Japanese specimens; conical teeth on vomerine series 25-35 and teeth on dentaries 65-75.

Eye large, diameter 2.3-2.5 times in head length, dorsal margin protruding above the margin of head. A roughly crescent-shaped, yellowish pigment patch present in the posterior half of iris. Aphakic space well developed. Anterior horizontal space nearly equal to width of iris, about twice width of posterior space. Aphakic space probably less well developed in smaller specimens, as is the case in other species.

Upper end of pectoral fin base above midpoint between lateral line and ventral margin of body, its lower end well above ventral margin of body by a distance more than (usually 1.5 to twice) length of pectoral fin base. Dorsal fin origin in front of center of body. Ventral fin base below or just behind posterior end of dorsal fin base. Adipose fin base above posterior half of anal fin base. Tip of mouth, snout, adipose, caudal and ventral fin bases pigmented.

SIZE. This species reaches about 200 mm SL. A specimen of 196 mm SL is reported to have ripe eggs (Abe, 1976).

DISTRIBUTION. Based on previous records, *N. ardesiaca* occurs in slope waters of Southeast Asian Seas, as far north

as off southern Japan. It also occurs in slope waters off the east coast of South Africa (Fig. 22).

Nansenia tenuicauda new species

Figures 14, 22

HOLOTYPE. ISH 658/71, 84.0 mm, FFS *Walther Herwig* sta. 363-II/71, 40°18'S, 39°12'W, 8 Mar. 1971, MT1600, 0-328 m.

PARATYPES. ISH 1010-71 (2, 70.5, 69.0), FFS *Walther Herwig* sta. 399-II/71, 40°34'S, 09°50'W, 18 Mar. 1971, MT1600, 0-310 m.

DIAGNOSIS. Differs in having four branchiostegal rays, predorsal length less than 49 percent of SL and 38-42 gill rakers on the first arch. Slender caudal peduncle the least depth of which is less than 5.5 percent of SL also distinguish this species from other species of *Nansenia*.

DESCRIPTION. D 10-11; A 8-10; P 11-13; V 11-12; gill rakers 11-15 + 1 + 25-26, total 38-42 with 38(1), 39(1), and 42(1); branchiostegal rays four; vertebrae 46. Counts are based on three specimens.

Pyloric caeca eight in one specimen. Conical teeth ca. eight, irregularly arranged on head of vomer and ca. 26 compressed teeth on dentaries. A pair of teeth on the symphysis longest of all. Other teeth of lower jaw, as usually observed in other species of *Nansenia*, are progressively smaller from the back of each dentary to the front.

Body subcylindrical, with a depth to width ratio of 1.3-1.4. Eye large, its diameter 2.8-3.0 times in head length; pupil ovoid in shape with aphakic space developed posteriorly.

Upper end of pectoral fin base just below the midpoint between lateral line and ventral margin of the body. Dorsal fin origin well in front of center of the body. Ventral fin base

below the posterior end of dorsal fin base. Adipose fin base above base of the last two anal fin rays.

Base of caudal fin densely pigmented, but pigment becoming progressively sparser anteriorly. Body color of preserved specimens light brown.

SIZE. The specimens examined, 69.0–84.0 mm SL, are probably juveniles.

DISTRIBUTION. Restricted to the area near the subtropical convergence in the South Atlantic, around 40°S.

ETYMOLOGY. From Latin, *tenuis*, slender, and from *cauda*, tail, in reference to the slender caudal peduncle.

Nansenia pelagica new species

Figures 15, 16, 22

HOLOTYPE. ISH 649/74 (1, 102.0), sta. A.D. 61-11/74, 02°27'N, 34°52'W, 24 Jan. 1974, MT1600, 0–350 m.

PARATYPES. Atlantic: ISH 1865/66 (1, 75.5), FFS *Walther Herwig* sta. 182-66, 10°46'N, 23°54'W, 16 May 1966, 0–300 m; ISH 442/66 (1, 93.0), FFS *Walther Herwig* sta. 184-66, 06°25'N, 24°34'W, 17 May 1966, 0–320 m; ISH 571/66 (1, 101.0), FFS *Walther Herwig* sta. 186-66, 01°24'S, 25°58'W, 19 May 1966, 0–330 m; ISH 619/66 (1, 64.8), FFS *Walther Herwig* sta. 187-66, 05°34'S, 26°58'W, 20 May 1966, 0–320 m; ISH 2066/71 (2, 101.5, 107.5), FFS *Walther Herwig* sta. 467-71, 05°30'S, 16°28'W, 9 Apr. 1971, 0–1900 m. Pacific: USNM 207532 (1, 83.7), 21°20'N, 158°20'W (off Hawaii), 16 Sep. 1970, 0–725 m.

OTHER MATERIALS. Atlantic: ISH 928/68 (1, 58.5), FFS *Walther Herwig* sta. 17-68, 04°43'S, 26°39'W, MT1600, 0–ca. 2000 m. Pacific: USNM 201704 (1, 27.0), R/V *Swan*, 28°48'N, 141°59'W, 6 ft.—IKMT, 200–247 m; USNM 212102 (2, ca. 60.5, ca. 54, damaged), from the stomach of a *Thunnus albacares* collected off the New Hebrides Is., 20°00'S, 170°03'E.

DIAGNOSIS. Differs from other *Nansenia* in having four branchiostegal rays and 38–39 vertebrae. Although it is similar to *N. atlantica*, and their distributions overlap in the tropical Atlantic, *N. pelagica* differs from *N. atlantica* in having lower vertebral counts (38–39 vs. 41–42), a longer head (27–30 percent of SL vs. 20–26 percent), and a dark pigment spot on the gular area that becomes obscure with growth in specimens larger than 90 mm SL.

DESCRIPTION. D 9–10; A 8–9; P 9–10 (rarely 11); V 10–11; gill rakers 10–13 + 1 + 24–27, total 36–41 with 36(2), 37(1), 38(3), 39(2), and 41(1); branchiostegal rays four, vertebrae 38–39 with 38(6) and 39(4). Counts are based on 10 specimens, 58.5–107.5 mm. Gill raker count of the one Pacific specimen was higher than counts from the Atlantic (41 vs. 36–38). Other counts showed no remarkable difference between the Pacific and Atlantic specimens.

Pyloric caeca seven and eight in the two Atlantic specimens. About 35 conical teeth on vomerine series and about 60 teeth, resembling a closely spaced picket fence, on the lower jaw of the specimens of 68.4 mm SL.

Body slender and slightly compressed, with a body depth-width ratio of 1.3–1.6 in specimens larger than 58 mm SL. Eye large, diameter 2.7–2.8 in head length in specimens 58.5–

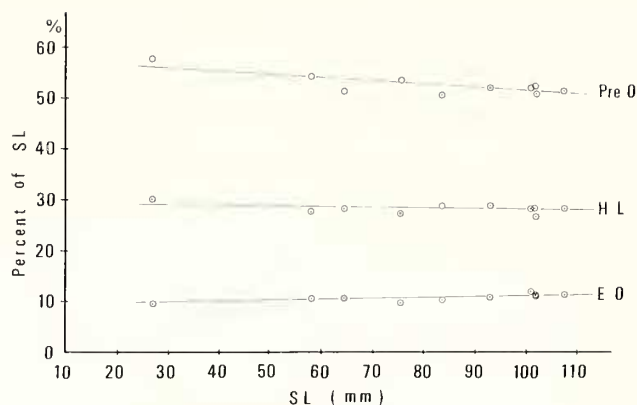


Figure 16. *Nansenia pelagica*. Predorsal, head lengths, and eye diameter in relationship to standard length.

93.0 mm SL, and 2.4 to 2.5 times in head length in specimens 99.5–107.5 mm SL. Yellowish pigment, in a roughly crescent-shaped patch, develops on posterior half of iris with growth. Aphakic space developed in front of lens. This space is inconspicuous in juveniles.

Upper end of pectoral fin base just below midpoint between lateral line and ventral margin of body, its lower end above ventral margin of body by a distance about 1.5 times as long as length of pectoral fin base. Origin of dorsal fin base just behind center of body. Adipose fin base over anterior half of anal fin base.

Body skinned in most specimens, but lateral line pockets remaining in some. Bases of caudal, dorsal, ventral and adipose fins, and dorsal margin darker than lateral side of body. Inside of opercle lined with dark membrane. Dark pigment spot on gular area clearly recognizable, especially in juveniles less than 70 mm SL.

SIZE. The largest specimen examined, probably an adult, was 107.5 mm SL.

DISTRIBUTION. *Nansenia pelagica* occurs in the tropical Atlantic between 15°N and 10°S. In the Pacific it is known only from the subtropical eastern North Pacific between Hawaii and North America and the tropical western South Pacific off the New Hebrides Islands.

ETYMOLOGY. In reference to the pelagic life of this species.

Nansenia atlantica Blache and Rossignol, 1962

Figures 17, 21

Nansenia atlantica Blache and Rossignol, 1962:105–106, fig. 1 (orig. descr. 16 mm SL, 01°55'S, 8°30'E; 15 mm SL, 03°36'S, 09°10'E).

MATERIALS. ISH 335/66 (2, 88.5, one damaged), FFS *Walther Herwig* sta. 182-66, 10°46'N, 23°54'W, 0–300 m; ISH 457/68 (4, 90.5–112.8, one damaged), FFS *Walther Herwig* sta. 11-I-68, 16°14'N, 22°24'E, 0–160 m; ISH 686/68 (1, ca. 161, damaged), FFS *Walther Herwig* sta. 13-II-68, 08°21'N, 24°10'W, 0–520 m; ISH 13-III-68 (1, 167.5), FFS *Walther Herwig* sta. 11-III-68, 16°08'N, 22°22'W, 0–580 m.



Figure 17. *Nansenia atlantica*. ISH 475-68, 104.5 mm SL, showing proximal part of adipose fin densely pigmented.

DIAGNOSIS. Differs from other species of *Nansenia* in having four branchiostegal rays, origin of dorsal fin base in front of center of the body, 41–42 vertebrae and dark pigment spot at the base of adipose fin. This species is closely related to *N. oblita* as all counts overlap. The densely pigmented proximal part of the adipose fin base in *N. atlantica* distinguishes the two.

DESCRIPTION. D 9–10; A 8–9; P 12–13; V 10–11; gill raker on the first arch 9–13 + 1 + 19–23, total 30–36 with 30(1), 31(2), 33(2), 35(1), and 36(1); branchiostegal rays four;

vertebrae 41–42 with 41(3) and 42(5). Counts are based on five to eight specimens.

Pyloric caeca seven in three specimens and nine in one specimen. Conical teeth on head of vomer 35, about 140 teeth on dentaries in one specimen.

Body slender and compressed laterally with body depth–width ratio, 1.4–1.6. Eye diameter 2.7–3.0 times in head length, viewed laterally its dorsal margin touching or protruding slightly higher than dorsal margin of head. Yellowish iridescent pigment pattern, roughly crescent-shaped, recog-



Figure 18. *Nansenia oblita*. USNM 92241, 39.1 mm SL, juvenile.



Figure 19. *Nansenia crassa*. LACM 9808-32, 165.2 mm SL.

nizable in the posterior half of iris. Pupil elliptical with aphakic space in front of lens.

Upper end of pectoral fin base well below midpoint between lateral line and ventral margin of body. Dorsal fin base originating just below center of body. Ventral fin base just in front of posterior end of dorsal fin base. Adipose fin base above center of anal fin base.

Body skin brown and easily rubbed off. The bases of adipose and caudal fins densely pigmented.

REMARKS. The original description of *N. atlantica* was based on two juvenile specimens of 16 and 15 mm SL. There is a considerable size gap between the type material and the smallest specimen available. Therefore, the present specimens are assigned to *N. atlantica* based on the coincidence of: (1) counts of branchiostegal and anal fin rays; (2) locality; (3) a wholly pigmented dark body surface. In the tropical Atlantic, two species of the Br-4 group occur, namely *N. atlantica* and *N. pelagica*. Juveniles of the latter differ from the former in the absence of complete pigmentation on the body.

SIZE. The largest specimens of 167.5 and 161 mm SL, collected in January, were mature males. An immature female of 112.0 mm SL was collected at the same time.

DISTRIBUTION. All specimens, including the types, were collected in the eastern tropical Atlantic between 20°N and 10°S (Fig. 21).

Nansenia oblita (Facciola, 1887)

Figures 18, 21

Microstoma argenteum oblitum Facciola, 1887:193 (orig. descr., Messina, Mediterranean).

Microstoma rissouanum Sarato, 1890 (orig. descr., Nice).

Microstoma oblitum: Belloti, 1888:224, figs. 3a, 3aA.

Nansenia oblita: Schmidt, 1918:19–22, figs. 13–14; Cohen, 1958:55.

Doubtful references:

Leuroglossus oblitus: Kuroda, 1947:25 (listed, no description, material unavailable); Kuroda, 1951:318.

Nansenia oblita: Matsubara, 1955:216 (cited from Kuroda, 1947).

MATERIALS. USNM 40075 (2, 40.5–48.5), from Messina, originally deposited in Royal Zool. Mus. Florence; USNM 92241 (3, 34.2–46.0), Mediterranean, originally deposited in Milano Mus.

DIAGNOSIS. Differs in having four branchiostegal rays, predorsal length longer than 50 percent of standard length, gill raker count 28–30 and proximal part of adipose fin unpigmented.

DESCRIPTION. D 10–11; A 9–10; P 10–11; V 10–11; gill rakers on the first arch 7–8 + 1 + 20–21, total 28–30 with 28(1) and 30(2); branchiostegal rays four on three spec-

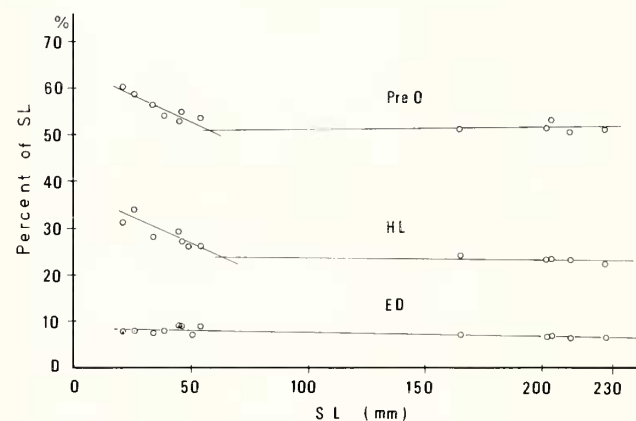


Figure 20. *Nansenia crassa*. Predorsal, head lengths, and eye diameter in relation to standard length.

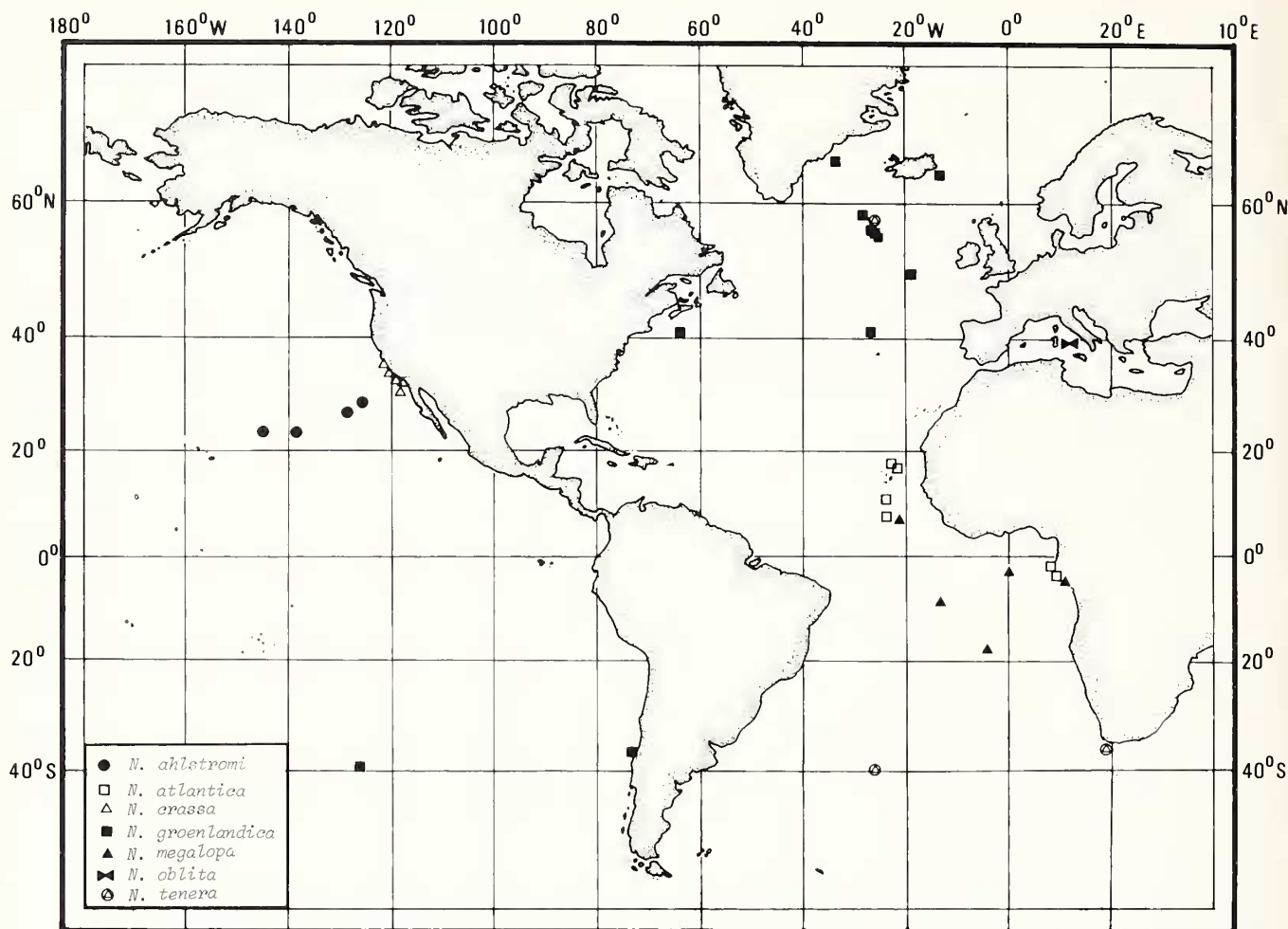


Figure 21. Distributions of specimens examined of seven species of *Nansenia*. A single symbol may indicate more than one record.

imens; vertebrae 42–45 with 42(1), 43(1), 44(2), and 45(1). Fin ray counts are based on four specimens.

Pyloric caeca eight in one specimen (seven reported by Schmidt, 1918); about 18 conical teeth irregularly arranged on head of vomer and about 30 compressed teeth on dentaries in a specimen of 48.5 mm SL. Measurements are based on four juveniles, 34.2–48.5 mm. The present counts and measurements are not very different from those presented for Mediterranean specimens by Schmidt (1918), except for the slightly lower pectoral and ventral fin ray counts in our material.

Body laterally compressed and stubby rather than slender with body depth–width ratio, 1.3–1.6. Eye diameter 3.0 to 3.4 in head length in juveniles (this ratio may be higher in adults due to negative allometry as observed in the closely related *N. crassa*); pupil nearly round in a specimen of 34.2 mm SL, horizontally elliptical in specimens larger than 39.1 mm.

Upper end of pectoral fin base above or on midpoint between lateral line and ventral margin of body, its lower end separated from ventral margin of body by a distance more

than length of pectoral fin base. Dorsal fin origin behind center of body. Ventral fin base below posterior end of dorsal fin base. Adipose fin base above the middle of anal fin base or slightly in front of it.

Entire body covered with guanine; base of caudal and procurrent caudal fin rays pigmented.

SIZE. Largest specimen reported by Belloti (1888) about 18 cm. Therefore the present material is probably all juvenile.

DISTRIBUTION. Common in the western Mediterranean (Schmidt, 1918). Although Schmidt (1918) reported two juveniles, 21 and 31.5 mm, from the temperate eastern Atlantic south of the British Isles (48°43'N, 12°05'W), we have seen only Mediterranean specimens, in spite of considerable fishing effort by FFS *Walther Herwig* in the eastern North Atlantic.

Nansenia crassa Lavenberg, 1965

Figures 19, 20, 21

Nansenia crassa Lavenberg, 1965:282–285, fig. 1, table 1 (orig. descr.).

MATERIALS. LACM 4425, holotype, 212.0 mm, R/V *Velero*, sta. IV8296, 33°17'N, 118°40'W, 1336–1642, 9 Nov. 1962, 0–580 m; LACM 4426, paratype, 202 mm, R/V *Velero*, sta. IV7374, 33°28'N, 118°18'W, 0200–0550, 29 Jun., 1961, 0–865 m; LACM 4427, paratype, 266 mm (275 mm in original), R/V *Velero*, sta. IV8934, 33°14'N, 118°33'W, 1559–1858, 18 Sep. 1963, 0–485 m; LACM 9031-6 (1, 26.3), R/V *Velero* IV, 33°20.0'N, 118°38.22'W, 0704–1022, 10 ft.—IKMT, 0–504 m; LACM 9068-1 (1, 44.5), R/V *Velero* IV, 33°36'48"N, 118°26'26"W, 1241–1445, 10 ft.—IKMT, 0–ca. 500 m; LACM 9681 (2, 33.5, 39.0), R/V *Velero*, sta. 11616, Valero Basin, Mexico; LACM 9808-32 (1, 165.2), R/V *Velero*, San Clemente Basin, Calif.; LACM 9809-1 (2, 34.0, 35.0), R/V *Velero*, sta. 10682, 29°17'00"N, 118°10'30"W, 10 ft.—IKMT; LACM 9965-9 (4, 19.0–22.0), R/V *Velero*, sta. 9891, San Juan Seamount; LACM 35549 (1, 203.6), R/V *Velero*, San Clemente, Calif.; SIO H51-190 (1, 238.0), 32°49'N, 117°41'W, 0–548 m; SIO 57-87 (1, 93.0), 29°15'N, 126°07'W, off Baja Calif.

DIAGNOSIS. Differs from other species of the genus in the following characters: (1) four branchiostegal rays; (2) predorsal length more than 49 percent of standard length; (3) 43–46 (usually 44–45) vertebrae; (4) length of caudal peduncle more than 13 percent of SL and depth of caudal peduncle less than 8.0 percent of SL (CPL/CPD ratio 1.7–2.2) in the specimens more than 30 mm SL. Gill raker count (35–37) also distinguishes this species from the closely related *N. oblita* (28–30).

DESCRIPTION. D 9–10; A 9 (rarely 8); P 11–13; V 10–11; gill rakers on the first arch 12–14 + 1 + 22–23, total 35–37 with 35(2), 36(2), and 37(2); branchiostegal rays four; vertebrae 43–46 with 43(1), 44(3), 45(5), and 46(2).

Pyloric caeca seven in two specimens; conical teeth in vomerine series 20–35, teeth on dentaries 150–180 in five specimens larger than 160 mm SL.

Morphometrics based on five juveniles and seven adults show remarkable allometric growth in head and predorsal lengths (Fig. 20).

Eye diameter 3.3 to 4.0 in head length with larger values in smaller specimens due to allometry; viewed laterally dorsal margin (supraorbital bone) protruding slightly above dorsal margin of head (less in juveniles); yellowish, crescent-shaped, pigment patch in posterior part of iris, sometimes obscure due to condition of preservation. Aphakic space well developed with its horizontal space about 1.5 times as large as width of anterior part of iris.

Upper end of pectoral fin base well below midpoint between lateral line and ventral margin of body; its lower end above ventral margin of body by a distance more than length of its base. Dorsal fin origin behind center of body. Ventral fin base below or slightly in advance of posterior end of dorsal fin base. Adipose fin base above center of anal fin base or slightly in front of it.

Skin around adipose fin base and caudal fin base pigmented. Ventral fin base slightly pigmented. Body color in preserved specimen brown.

SIZE. The largest specimen examined was 266 mm SL, with mature ovaries in September.

DISTRIBUTION. *Nansenia crassa* is found in the California Current region between 25°N and 35°N, where its distribution overlaps that of *N. candida* off mid- and southern California. It also occurs in the eastern tropical Pacific along the equator between 8°N and 7°S west to at least 126°W (Ahlstrom, 1971, 1972). The pattern of occurrence of adult specimens is associated with slope waters off California, suggesting that the adults there are benthopelagic life on the continental or insular slope. Larvae and juveniles are pelagic in the upper 200-m layer and are more broadly distributed than are adults. The larvae of *N. crassa* can be distinguished from those of *N. candida*. The geographical distributions of the larvae of the two species correspond largely to the distributions of the adults, although there is a larger area of overlap in the larvae. Specimens between 60 mm and 160 mm SL are completely lacking in our material. The size at which the specimens begin to disappear from our material corresponds to an abrupt change in allometric growth (Fig. 20). At this size, 50–60 mm SL, *N. crassa* may change its vertical distributional pattern from pelagic to benthopelagic life and become unavailable to either pelagic micronekton nets or bottom trawls with coarse mesh.

DISCUSSION

DISTRIBUTION PATTERN AND ZOOGEOGRAPHY

There are two types of distribution patterns, coastal and oceanic, among the species of *Nansenia*.

Nansenia ardesiaca is restricted to slope waters associated with insular or continental slopes, indicating a pseudo-oceanic distribution (Krefft, 1974). Sampling data suggest that this species is pelagic during larval and juvenile stages, but becomes benthopelagic as an adult. A distribution pattern similar to that of *N. ardesiaca* is not uncommon among slope water species of myctophids such as *Diaphus watasei*, *D. garmani*, *D. suborbitalis*, *Benthosema fibulatum*, and *B. pterotum* (Nafpaktitis, 1978; Gjøsæter, 1981). These myctophids are distributed in Southeast Asian Seas and extend to off southern Japan and westward in the Indian Ocean to the Mozambique Channel, although few samples exist from the slope waters off India. Of the remaining 11 species, three (*N. crassa*, *N. oblita*, and *N. candida*) show an intermediate pattern of distribution between coastal and oceanic (Figs. 21, 22). Off southern California *N. crassa* has a coastal distribution, however the larvae are oceanic in the eastern tropical Pacific (Ahlstrom, 1971, 1972). The other nine species are all oceanic.

The 13 species may also be grouped into cold-water forms, four species; warm-water forms, seven species (*sensu* Johnson, 1982); and transitional forms, two species.

Of the four cold-water species, *N. candida* occurs only in the subarctic eastern Pacific. Kanayama and Amaoka (1983) described *Nansenia sanrikuensis*, the validity of which requires further confirmation, from the subarctic waters of the western Pacific off Japan. Species assemblages have been recognized in the myctophids of both the eastern and western

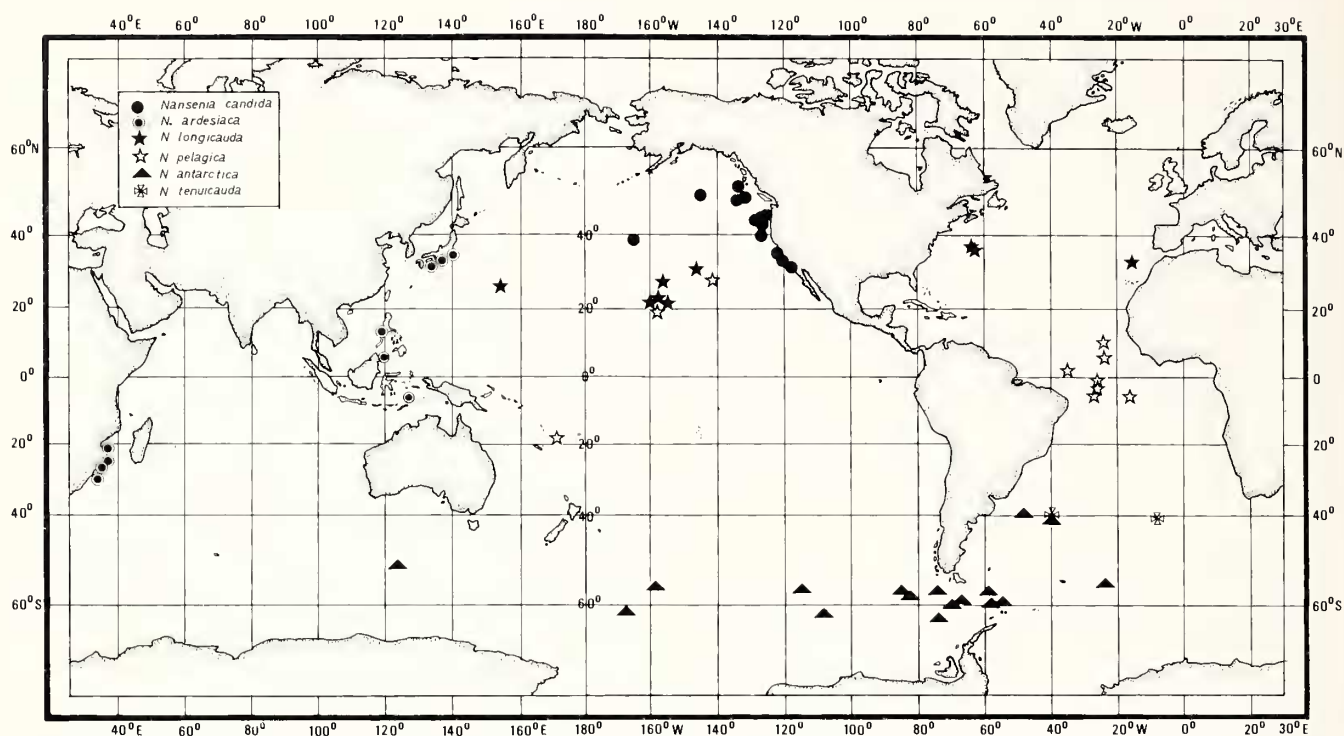


Figure 22. Distributions of specimens examined of six species of *Nansenia*. A single symbol may indicate more than one record.

parts of the subarctic Pacific, which includes *Diaphus theta*, *Lampanyctus ritteri*, *L. jordani*, *Stenobrachius leucopsarus*, *S. nannochir*, *Symbolophorus californiensis*, and *Tarletonbeania crenularis* (Wisner, 1974). Clinal variation occurs in the eye diameter of *D. theta* (Nafpaktitis, 1978; Kawaguchi and Shimizu, 1978) and in the shape of the caudal luminous scales of *S. californiensis* (Wisner, 1974 and pers. commun.) A similar species-subspecies problem exists in *Tarletonbeania* (Wisner, 1959; Becker, 1966). Definitive comparative examination of these species assemblages based on materials not only from both sides of the subarctic Pacific, but from the central area is needed. At present, it is not possible to establish either a clear break in the distribution of the eastern and western populations (or species) or clinal variations in characters.

Other cold-water species, *N. tenera* and *N. groenlandica*, belong to a subpolar-temperate group based on the system of distribution patterns recognized for Atlantic midwater fishes by Backus et al. (1977). These two species occur in both hemispheres, although *N. groenlandica* in the southern hemisphere is restricted to the subpolar-temperate region of the eastern South Pacific. However, some bipolar species of the subpolar-temperate group in the Atlantic such as *Lampanyctus macdonaldi* (Wisner, 1974; Backus et al., 1977) and *Gonostoma bathyphilum* (Mukhacheva, 1972) are found westward to the eastern South Pacific and occur north to Chile. Therefore additional sampling might establish the presence of *N. groenlandica* in the subantarctic Atlantic. Of the remaining cold-water species, *N. antarctica* is probably

circumpolar along the Antarctic convergence, although collections are needed in the Indian Ocean sector.

Two of the seven warm-water species, *N. atlantica* and *N. megalopa*, occur only in the eastern tropical Atlantic. According to the Atlantic faunal regions recognized by Backus et al. (1977), both species inhabit the Guinean Province of Atlantic Tropical Region (Fig. 21). The distribution of *N. atlantica* appears to be restricted to the more productive area near the Mauritanian upwelling and to just off the Guinean coast. The other two warm-water species, *N. longicauda* and *N. pelagica*, are widely distributed in the Atlantic and Pacific oceans with the former restricted to the subtropical region between 20°N and 40°N and the latter to the tropical region between 20°N and 20°S in the Atlantic and between 30°N and 20°S in the Pacific. *Nansenia ahlstromi* is restricted to the central Eastern North Pacific. There is nothing to add to the previous discussion of the distribution of the remaining two warm-water species, *N. oblita* and *N. ardesiaca*.

BODY COLOR

There have been many descriptions of the body color of *Nansenia*, which suggest two patterns, silvery and colored. During the course of this study, however, it has been observed that the silvery color pattern is variable, depending upon preservative; it is easily lost in formalin. For example, the type of *N. ardesiaca* (Fig. 13a), which is now dark colored, was originally described as "color brilliant silvery . . . scales of a bright, silvery appearance" (Jordan and Evermann, 1896).

Some specimens examined (Fig. 13b) still bear complete guanine after more than 50 years of preservation in ethanol in a dark place. But these specimens are usually so soft that careful handling is necessary, indicating that they were not fixed well in formalin.

INTERRELATIONSHIPS

Various character states studied here are shared independently among 13 species and it is difficult to discuss the relationships within the species of *Nansenia*. Although the key separates species on the number of branchiostegal rays, loss of a branchiostegal ray could have occurred more than once. It is also possible to separate the species of this genus into three groups based on morphology, mainly of the caudal peduncle. With the exception of *N. antarctica*, the species of *Nansenia* are separable into the following three distinctive groups based on the ratio of caudal peduncle length to caudal peduncle depth (CPL/CPD, Tables 1 and 2):

Stubby-tailed group CPL/CPD = 1.0–1.5

Intermediate group CPL/CPD = 1.7–2.3

Slender-tailed group CPL/CPD = 2.7–4.1

The ratios are not overlapping. The stubby-tailed group includes four species: *N. ahlstromi* (Br 3), *N. oblita* (Br 4), *N. atlantica* (Br 4), and *N. pelagica* (Br 4). The slender-tailed group includes: *N. groenlandica* (Br 3), *N. tenuicauda* (Br 4), *N. megalopa* (Br 4), and *N. longicauda* (Br 4). Of the remaining five, four species, *N. candida* (Br 3), *N. crassa* (Br 4), *N. ardesiaca* (Br 4), and *N. tenera* (Br 4), are included in the intermediate group. *Nansenia antarctica* (Br 3) shows remarkable allometric growth in the caudal peduncle; the range of the CPL/CPD ratio for specimens less than 110 mm SL was 2.5–3.0; but the ratio for specimens larger than 110 mm SL was 2.0–2.5. This overlaps the range between intermediate and slender-tailed groups.

No correspondence is recognized between groupings based on the number of branchiostegal rays or morphology. This suggests that natural groups cannot be defined by branchiostegal ray counts alone.

ACKNOWLEDGMENTS

We thank the late E.H. Ahlstrom whose interest in and enthusiasm for fish systematics were largely responsible for this study. We are greatly indebted to H.G. Moser and his colleagues of the Southwest Fisheries Center for their continuous help and kindness during the course of this study. The following people and their institutions allowed us to examine the materials in their care: E. Bertelsen (ZMUC); G. Krefft and A. Post (ISH); R.J. Lavenberg (LACM); R.H. Rosenblatt (SIO); W.G. Pearcy (OSU); S.H. Weitzman (USNM); R.K. Johnson (FMNH); W.N. Eschmeyer (CAS); G.H. Burgess (UF); O. Okamura (KU). We would also like to thank D.M. Cohen (LACM), R.H. Rosenblatt (SIO), and D.L. Stein (OSU) for reading the manuscript and for their many helpful comments. The authors thank I. Barrett, director of the Southwest Fisheries Center and Professor Emeritus R. Marumo of University of Tokyo for giving them a chance to complete this study.

Partial financial support from the Japanese Ministry of Education, special project research "Studies on biological processes in the sea and technical development of marine resources" (No. 57108013) is also acknowledged.

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Accepted 28 March 1984.